Appendix C. – Forms and Distributed Information

North Fork of the Kentucky River Water Well 319 Nonpoint Pollution Study

Field Inspection Check Off Sheet

Kentucky Division of Water, Groundwater Branch
1-502-564-3410

Well ID. Number _____-_____ County Letcher
Well Owner_____

USGS Topographic Quadrangle Name_____

Well and Water Delivery System

The wellhead appears to be sealed and properly constructed. ☐ Yes, ☐ No, explain
_____
_____
_____

The well provides a sufficient supply of water. ☐ Yes, ☐ No, explain
_____
_____
_____

Water quality and quantity has not changed over time. ☐ Yes, ☐ No, explain
_____
_____
_____

The well was disinfected in the past year. ☐ Yes, ☐ No, explain
_____
_____
_____

The well water was tested in the past year. ☐ Yes, ☐ No, When was the well last tested?
_____
_____
_____

The well is a sufficient distance from any septic system. ☐ Yes, ☐ No, explain
_____
_____

The delivery system parts that are visible are in good condition and appear to be constructed out
Of materials approved for drinking water systems. ☐ Yes, ☐ No, explain
_____
_____

There are no unused wells on or near the property. ☐ Yes, ☐ No, explain
_____
_____

There are no unsafe activities, either point or non-point pollution source activities, are being conducted near the well which could impact the well and groundwater. ☐ Yes, ☐ No, explain

_____
_____
_____

Potential Pollution Sources

Fuel Storage Tank- above or below ground ☐ Yes, explain ☐No

_____
_____
_____

Animal Pen ☐ Yes, explain ☐No

_____
_____
_____

Trash Pile or dump ☐ Yes, explain ☐No

_____
_____
_____

Trash Burning Area ☐ Yes, explain ☐No

_____
_____
_____

Indications of Dumping of Waste Oil ☐ Yes, explain ☐No

_____
_____
_____

Mining ☐ Yes, explain ☐No

_____
_____
_____

Cemetery ☐ Yes, explain ☐No

_____
_____
_____

Auto Repair or Salvage Facility ☐ Yes, explain ☐No

_____
_____

Septic tank has not been pumped out in the last five years. ☐ Yes, explain ☐No

_____
_____

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General Comments, suggestion, and recommendations.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Sketch Map (if needed)

Literature Distributed

- ☐ Kentucky Well Inspection Form. (Well Owners Copy)
- ☐ Field Analytical Data Screening Sheet (Well Owners Copy)
- ☐ Handbook for the Kentucky Water Well Owner.
- ☐ Field Inspection Check Off Sheet (Well Owners Copy)
- ☐ Generic Groundwater Protection Plan (GPP) for Water Well Owners.
- ☐ Generic Groundwater Protection Plan (GPP) for Septic System Owners.
- ☐ Routine Water Well Maintenance and Disinfection Guide
- ☐ Groundwater Protection and Residential Septic Systems
- ☐ 10 Ways you can Keep Kentucky Waters Clean!
- ☐ Watershed Management in Kentucky…Q&A for Homeowners
- ☐ Kentucky Division of Water
- ☐ Groundwater….Protecting it is Now the Law
- ☐ Inside the Kentucky NREPC
- ☐ Private Drinking Water Wells, USEPA, Office of Ground Water and Drinking Water
- ☐ USEPA Consumer Fact-sheet on: NITRATES/NITRITES
- ☐ Requirements for Installing a Residential Wastewater Treatment Facility
- ☐ Pesticide Use and Application Act, KRS 217B
- ☐ Floodplain Management in Kentucky
- ☐ Kentucky River Basin Status Report, November 1997
- ☐ Kentucky Natural Resources Cost-share Programs
- ☐ Kentucky's Master Logger Program
- ☐

☐ *(Required handout)*

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Informational Contacts:

Division of Water -

Water wells, stream quality, water withdrawals, water discharges, non-point pollution, drinking water plants, waste water plants.

Frankfort Office	1-(502)-564-3410
Hazard Field Office	1-(606)-435-6022
Water Watch Program	1-(800)-928-0045

Division of Waste Management -

Dumps, junk collection program,

Frankfort Office	1-(502)-564-6716
Hazard Office	1-(606)-435-6022
Report a Dump Hot line	1-(888)-NO DUMPS (1-888-663-8677 toll free call)

Division of Air Quality -

Air issues

Frankfort Office	1-(502)-573-3382
Hazard Field Office	1-(606)-435-6022

Letcher County Action Team -

Assistance with septic system design and installation. Some grant and loans available for straight pipe elimination.
1-(606)-633-3014

Cabinet for Health Services -

Septic system questions, alternate septic system design information, septic system regulations.

Frankfort	1-(502)-564-4856

Environmental Response -

24-hour toll free number to report spills, leaks, fish kills, illegal dumping, etc.

1-(800)-928-2380 or 1-(502)-564-2380

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North Fork of the Kentucky River Water Well 319 Nonpoint Pollution Study

Field Analytical Data Screening Sheet

Kentucky Division of Water - Groundwater Branch

Well ID. Number _____-_____ County __Letcher_____

Well Owner_____

USGS Topographic Quadrangle Name_____

Field Results

☐ Nitrate-**N** 0---2.5---5---***10***---15---20---25---37.5---50---62.5---75---87.5---100---112.5---125 PPM $N0_3$-N

☐ May exceed primary drinking water standards ☐ Sample taken for lab verification

☐ Nitrite-**N** 0---***1***---1.25---2.5---3.75---5---6.25---7.5---10---15---20---25---30---35---40---45---50 PPM NO_2-N

☐ May exceed primary drinking water standards ☐ Sample taken for lab verification

☐ Ammonia-**N** 0---2.5---5---7.5---10---15---20---25---50---75---100---125---150---175---200---250 PPM NH_3-N

☐ Sample taken for lab verification

☐ Detergents 0----0.25---0.50---0.75---1.0---1.5---2.0---3.0 PPM Anionic Detergents

☐ Sample taken for lab verification

☐ Phosphate-**PO_4** 0---2.2---5---7.5---10---15---20---50---75---100---125---150---175---200---250 PPM PO_4

☐ Sample taken for lab verification

☐ pH _____***(6.5-8.5)*** ☐ Eh _____ ☐ Conductivity _____ ☐ Temperature_____

Optional Tests

☐ Iron, **Total Fe** 0---0.1---0.2---0.3---0.4---***0.5***---0.6---0.8---1.0---2---3---4---5---6---7---8---10 PPM Total Fe

☐ May exceed secondary drinking water standards ☐ Sample taken for lab verification

☐ Iron, **Dissolved** 0---0.1---0.2---0.3---0.4---***0.5***---0.6---0.8---1.0---2---3---4---5---6---7---8---10 PPM Dissolved Fe

☐ May exceed secondary drinking water standards ☐ Sample taken for lab verification

☐ Manganese, **Soluble** 0---***0.05***----0.3---0.6---0.8---1.0---1.5---1.8---2.0 PPM Mn

☐ May exceed secondary drinking water standards ☐ Sample taken for lab verification

☐ Nitrate **Test Strip**, **NO_3^-** 0----10----25----***50***----100----250----500 PPM NO_3^- (10ppm NO_3^- = 2.3 ppm N)

☐ May exceed primary drinking water standards ☐ Sample taken for lab verification

☐ Nitrite **Test Strip,** **NO_2^-** 0----2---***3.3***--5----10----20---40----80 PPM NO_2^- (10ppm NO_3^- = 3 ppm N)

☐ May exceed primary drinking water standards ☐ Sample taken for lab verification

☐ Other Test _____

BART Test Collected? (This test needs several days before the results can be read)

☐ Iron Reducing Bacteria Reactions BC BG BL BR CL FO GC RC Days till reaction_____

☐ Sulfur Reducing Bacteria Reactions BB BT BA CG Days till reaction_____

☐ Slime Forming Bacteria Reactions DS SR CP CL BL TH PB GY Days till reaction_____

Disclaimer - These test only are used for screening for nonpoint pollution and therefore are not absolute results. Any result, which is equal to or above one-half the drinking water standard, will be verified in the lab under laboratory standards to determine the validity of the result. Additional random control samples will be taken to the lab to confirm the validity of the field-testing. Questions concerning these results should be directed to: Groundwater Branch, Kentucky Division of Water, 14 Reilly Road, Frankfort, KY 40601 or by calling 1-502-564-3410.

Bacteriological Sampling Postcard

I would like to participate in the one time bacteriological sampling for the ***"Assessment of Nonpoint Source Pollution Impacts on Groundwater in the Headwaters of the North Fork of the Kentucky River Basin"*** project which will occur during the week of September 10-13, 2001.

My mailing address is:

Name
Address
Mayking, KY 41837

My 911 street address is:

_____

_____

The best time to catch me at home is:
? Morning ? Afternoon

? A sample can be taken at an outside faucet if I am not at home. The faucet is located

Bacteria Chain Of Custody Record

NATURAL RESOURCES AND ENVIRONMENTAL PROTECITON CABINET
DIVISION OF WATER - GROUNDWATER BRANCH - North Fork 319- Funding Source A-21

Site Identification	**Collection Date/Time**	**Field Measurements**
Location: **«Name»** County: Letcher County AKGWA #: **«AGWA»**	Date: _____ Time: _____	pH: ___NA_ Conductivity: ___NA___ µmhos Temp: _NA__ °C Spring flow: _____

Sampler ID: _____

Division of Water Hazard Laboratory Samples			
Analysis Requested	**Container Size, Type**	**Preservation Method**	**Parameters**
X	1 - 250 ml bottle Label with stick on labels	Cool to 4°C	**Total Coliform, Fecal Coliform and E-Coli Bacteria** By Colilert
X	1 - 1000 ml amber glass bottle	Cool to 4°C	**Caffeine**

Signatures:

Relinquished by: _____ Date: _____Time: _____
Received by: _____

Relinquished by:_____Date: _____ Time: _____
Received by:_____

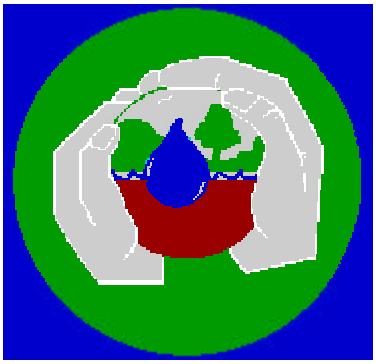
Relinquished by:_____Date: _____ Time: _____
Received by:_____

Relinquished by:_____Date: _____Time: _____
Received by:_____

Sample #:_____ Report #:_____

DISCARD SAMPLES UPON COMPLETION

Kentucky Division of Water
PROTECTING YOUR WELL AND WATER SUPPLY



A Groundwater Protection Plan For Domestic Well Owners

Why is protecting my well important?

Groundwater is an important but vulnerable source of fresh water for drinking, household use, industry, and farming. It is also the only source of water for private wells and many public utilities. Kentucky's groundwater supply can be polluted by activities above ground. Implementing groundwater protection best management practices (*e.g*. proper well siting, construction, and maintenance) is essential to safeguard your groundwater supply and to protect groundwater for generations to come.

How do I protect my groundwater?

You can protect your groundwater supply by carefully managing activities at the surface, especially in those areas where groundwater may be more easily contaminated, such as near sinkholes, around your septic system, and near your domestic water well. Best management practices are outlined in this generic groundwater protection plan for activities near and related to your domestic water well. Implementing this groundwater protection plan will go a long way toward preventing groundwater pollution and ensuring the safety of your water source, now and in the future.

What is a groundwater protection plan?

The Natural Resources and Environmental Protection Cabinet administrative regulation, 401 KAR 5:037 requires anyone participating in certain activities to develop and implement a

groundwater protection plan. Construction, operation, closure, and capping of water wells are some of the activities that require a groundwater protection plan. The cabinet has developed groundwater protection plans for these activities. This publication is the generic groundwater protection plan for domestic well owners.

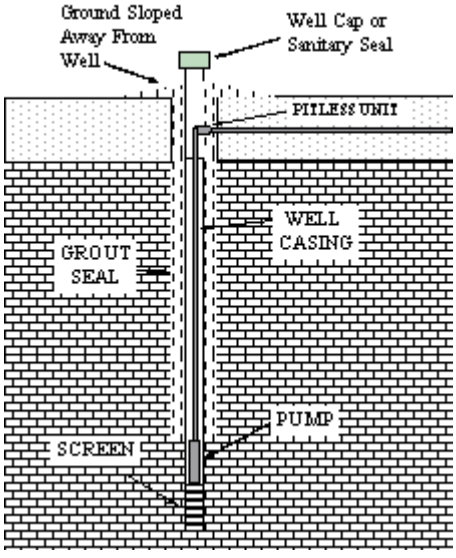
Am I required to have a groundwater protection plan?

Yes. If you own a domestic-use water well, regulation 401 KAR 5:037 requires you to develop or adopt a groundwater protection plan, to certify that you will implement a groundwater protection plan, and to keep a copy of the certified groundwater protection plan on the site where the domestic water well is located.

How does this groundwater protection plan protect my groundwater supply?

This groundwater protection plan outlines operation and maintenance practices to protect your well from contamination. It includes an area for simple record keeping of operation and maintenance practices. The plan also outlines activities and practices to be avoided in the operation and maintenance of your well, including procedures for proper well abandonment. It also includes some potentially polluting activities to be avoided near your well.

Typical properly constructed well:



Protecting Your Groundwater Supply

The goal of a groundwater protection plan is to protect your groundwater supply from potential pollution. You can protect the groundwater supply to your domestic well by following best management practices. Follow the best management practices outlined below to implement this generic groundwater protection plan.

1. Inspect exposed parts of the well periodically for problems such as: - cracked or corroded well casing - broken or missing well cap - damage to protective casing - settling and cracking of surface seals.
2. Slope the area around the well so that surface runoff drains away from the well.
3. Provide a well cap or sanitary seal to prevent unauthorized use of or entry into the well.
4. Disinfect drinking water wells at least once a year using bleach or hypochlorite granules (see Table I).
5. Provide for sediment removal or well cleaning as necessary.
6. Have the well tested once a year for fecal coliform or other constituents that may be of concern.
7. Contact your local health department for assistance with well testing.
8. Keep accurate records of any well maintenance, such as disinfection or sediment removal, that might require use of chemicals in the well.
9. Use a Kentucky certified water well driller for any new well construction or modification and proper well abandonment.
10. Located your well a minimum distance from the following potential sources of contamination:
    - animal pens or feedlots (50 feet) and manure storage areas (75 feet)
    - septic tanks (50 feet), lateral fields (70 feet), cess pools (150 feet), or pit privy (75 feet)
    - chemical storage areas (suggest 75 feet)
    - machinery maintenance areas (suggest 75 feet)
    - waste piles (suggest 75 feet), lagoons (suggest 150 feet), sewers (15-50 feet, depending on type)
    - underground storage tanks for chemicals, fertilizers, or petroleum products (suggest 75 feet)
    - above-ground tanks for chemicals, fertilizers or petroleum products (suggest 75 feet)
11. If an existing well is located closer than the specified distance for any of the above activities, then disinfection and appropriate well testing should be done more frequently than once a year.
12. Avoid mixing or using pesticides, fertilizers, herbicides, degreasers, fuels, or other pollutants near your well.
13. Do not use dry wells or wells that are not properly abandoned for disposal.
14. Do not locate any type of potentially polluting activity up slope from your well.
15. Do not cut off well casing below the ground surface because doing so leaves the well more vulnerable to contamination.

For Your Records.

An important part of complying with the groundwater protection regulations is keeping accurate maintenance and disinfection records for the well. The following table will help you maintain proper records for your well.

Disinfection:

Method	Date
_____	_____

Table 1. shows one method of well disinfection.

Well diameter in Inches	Amount of Bleach Required to Disinfect Well per 100 Feet of Water in Well
3	1 cup
4	2 cups
5	3 cups
6	4.5 cups
8	8 cups
10	12 cups
12	18 cups

Other Well Maintenance:

Type of Maintenance Date

Certification

Each domestic water well owner is required to implement a groundwater protection plan. You may fulfill this requirement by using this document and signing the certification statement below. You must retain this document at the location served by the well. I certify that I have read and will implement this groundwater protection plan.

_____ _____

(Signature of well owner) (Date)

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Generic Groundwater Protection Plan: Residential Septic Systems

Natural Resources and
Environmental Protection Cabinet

Generic Groundwater Protection Plan:
Residential Septic Systems

HOMEOWNER'S SEPTIC SYSTEM GUIDE AND RECORD KEEPING FOLDER

The purpose of 401 KAR 5:037 and this groundwater protection plan is to prevent groundwater pollution. Understanding how your septic system works and following good operation and maintenance practices are the keys to preventing groundwater pollution.

This folder provides you with that information. By carefully reading it and following the guidelines, you will not only protect groundwater, but also should receive many years of trouble-free service from your system.

FOR YOUR RECORDS

Keeping records will enable you to better protect and maintain your septic system. In case you sell your house, your records will show a prospective buyer that your system has been properly maintained.

What to keep?

1. Maintenance Log: Date, what was done and reason for the maintenance (Example: measure sludge and scum layers, pump the tank).

2. Inspection Log: Date, what you observed upon walking over the septic system (Example: any unpleasant odors, soggy soil, lush green grass over the lateral lines, surfacing wastewater).

3. Site Drawing: Show accurately the layout of the system on your lot. Include exact distances of each portion of the system from at least two (2) fixed reference points (corner of house, garage, large trees, property line markers).

4. Any permits or receipts.

5. Residential Address _____
_____

Septic system type:

_____ Septic tank - drainfield
_____ Septic tank - constructed wetland - drainfield
_____ Septic tank - leaching chambers
_____ Septic tank - low pressure pipe
_____ Septic tank - sewage lagoon - drainfield
_____ Septic tank - gravelless pipe

Sketch System Layout Here

System Inspection Log

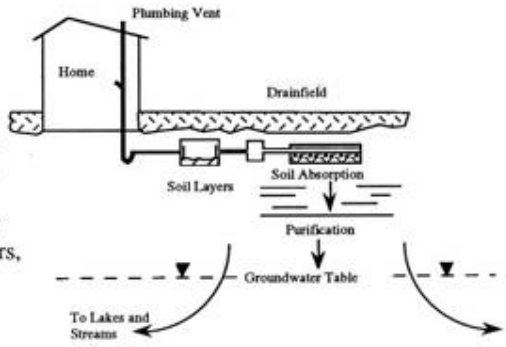
DATE	DESCRIPTION

System Maintenance Log

DATE	DESCRIPTION

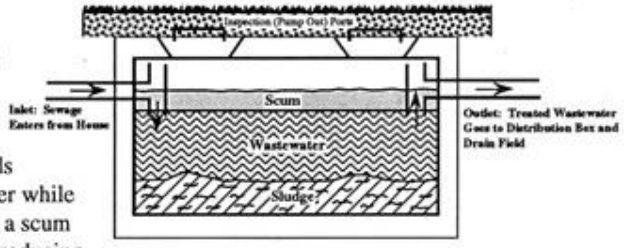
SYSTEM DESCRIPTION

A septic system uses natural processes to treat and dispose of the wastewater in your home. It typically consists of a septic tank and a drainfield (also called a leachfield, lateral field, or subsurface soil absorption beds/trenches). The system accepts both "blackwater" (toilet wastes) and "greywater" (wastes from the kitchen sink, bath tub/showers, and laundry). Water that should not be discharged to the system includes water from foundation or footing drains, roof gutters, and other "clear" water.



Basic System

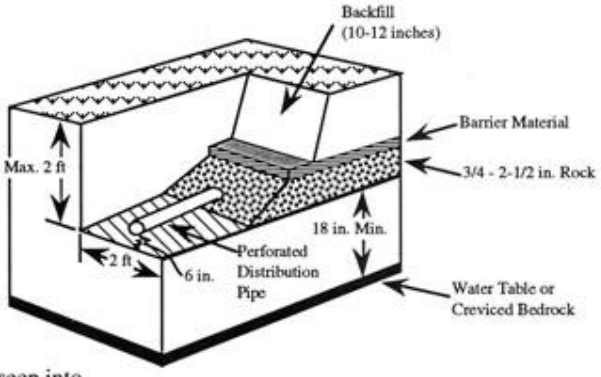
SEPTIC TANK



Septic Tank Cross-Section

The septic tank provides the first step in treatment by separating the solids from the liquids. The wastewater is retained in the tank for 24 hours or more. During this time the heavier solids settle to the bottom to form a sludge layer while the lighter solids float to the top to form a scum layer. Bacteria break down the solids, producing carbon dioxide, hydrogen sulfide, and other gases in the process. These gases are vented through the plumbing vent on your house roof. Since the bacteria reduce only about 40 percent of the sludge and scum volume, the tank must be pumped regularly (approximately every three to five years) to remove the accumulated solids. If the tank fills with sludge and scum, the solids will overflow into the drainfield and quickly clog the soil, resulting in system failure.

THE DRAINFIELD

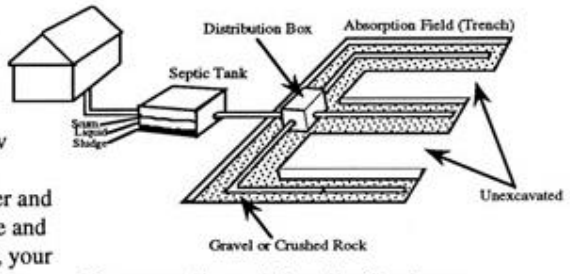


Conventional Rock Drainfield Trench Cross-Section

The drainfield provides the final treatment of the wastewater and disposes of it through groundwater recharge. The typical drainfield is composed of trenches or beds which are shallow, level excavations installed one to one and a half feet above the groundwater table. Each trench contains a perforated distribution pipe through which wastewater drains into the gravel. The water is stored in the gravel until it can seep into unsaturated soil underlying and adjacent to the trench. As the wastewater moves slowly through the gravel and soil, many of the disease-causing bacteria and viruses are filtered out, or adsorbed and held by the soil particles until they die. Where soils do not permit a drainfield to adequately treat septic tank effluent, an additional or alternative treatment system must be used in conjunction with the drainfield. Alternative systems primarily used in Kentucky are constructed wetlands and sewage lagoons. These alternative systems have their own operation and maintenance guidelines. If you would like information about these guidelines, contact the Groundwater Branch.

TAKING CARE OF YOUR SYSTEM

Your septic system represents a significant investment worth protecting. The old adage "An ounce of prevention is worth a pound of cure" is so true when it comes to the care of your septic system. If you follow the operation and maintenance guidelines given below, your system will function better and last longer, and you will avoid the nightmare and expense of a failed system. Most important, your system will not be polluting groundwater.



Conventional Septic System

DO

- Conserve water to reduce the amount of wastewater that must be treated and disposed.
- Repair any leaking faucets and toilets.
- Discharge only biodegradable wastes into system.
- Divert down spouts and other surface water away from your drainfield.
- Keep your septic tank cover accessible for tank inspections and pumping.
- Have your septic tank pumped regularly and checked for leaks and cracks.
- Call a professional when you have problems.
- Compost your garbage or put it in the trash.

DON'T

- Use a garbage grinder.
- Flush sanitary napkins, tampons, disposable diapers, condoms and other non-biodegradable products into your system.
- Dump solvents, oil, paints, thinners, disinfectants, pesticides or poisons down the drain. These materials can disrupt the treatment process and contaminate the groundwater.
- Dig in your drainfield or build anything over it.
- Plant anything over your drainfield except grass.
- Drive over your drainfield or compact the soil in any way.

If you have a question or need additional information, contact:

Groundwater Branch
Kentucky Division of Water
Natural Resources and Environmental
Protection Cabinet
14 Reilly Road
Frankfort, Kentucky 40601
(502) 564-3410

Environmental Management Branch
Division of Environmental Health
and Community Safety
Cabinet for Human Resources
275 E. Main Street
Frankfort, Kentucky 40601
(502) 564-4856

Check List
for
Evaluating Your Septic System

1 Find and mark the location of the septic system, You should map this information in the space provided in your Groundwater Protection Plan: "Homeowner's Septic System Guide and Record Keeping Folder."

2 When was the septic tank last pumped?

_____

3 If the tank was last pumped over three years ago, or if you have recently moved into the house and don't know when the tank was last pumped, contact a septic tank pumper. Have him service the tank and check the baffles.

4 Do toilets flush slowly and does water drain slowly from sinks and tubs, or does either "gurgle"?

Yes☐ No☐

5 Is there any standing water, soggy ground, or smelly liquid in or near the drainfield?

Yes☐ No☐

6 Does the ground slope toward the septic system?

Yes☐ No☐

7 Are your septic tank and drainfield less than 100 feet from a lake, stream, or pond?

Yes☐ No☐

8 Are water-loving trees such as willows, sycamores, birches, or water maples growing within 10 feet of the septic tank?

Yes☐ No☐

9 Are there any areas over the septic tank or drainfield where people have frequently driven their cars or trucks?

Yes☐ No☐

10 Have any additions been made to the house since the present septic system was installed?

Yes☐ No☐

11 Do you have dripping faucets or a toilet that runs continuously or gradually loses water from its tank?

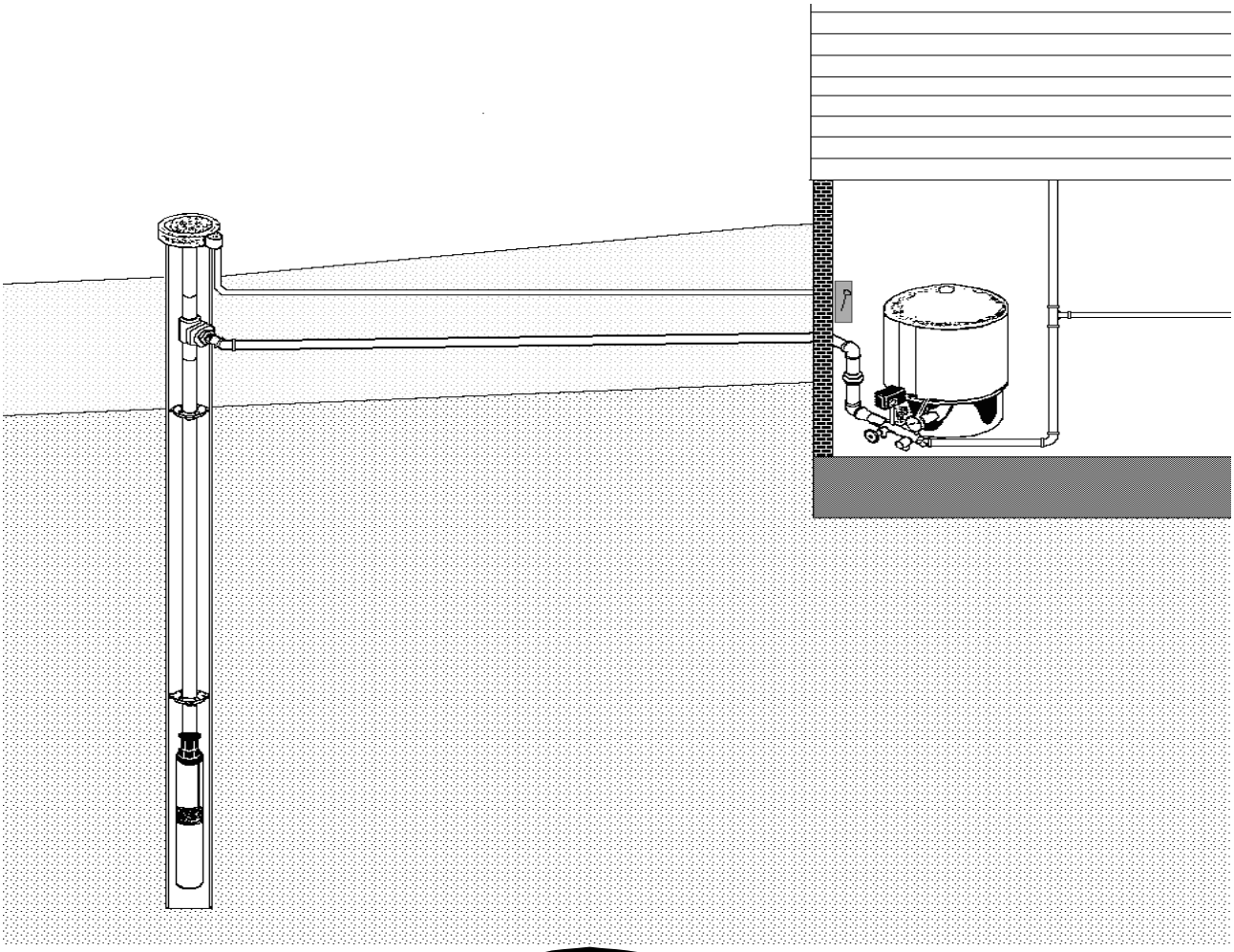
Yes☐ No☐

12 Do you put cigarette butts, coffee grounds, cooking fats, disposable diapers, facial tissue, wet-strength towels, or other non-biodegradeble materials into your septic tank?

Yes☐ No☐

If you have answered YES to one or more of questions 4 - 12, the septic system may not be functioning correctly. Call your local health department, or seek other professional help. Should repair of the system be necessary, be sure to engage the services of a professional who has a groundwater protection plan on file. If you have any questions, contact the Groundwater Branch, Division of Water, 14 Reilly Road, Frankfort, KY 40601 (telephone 502/564-3410) or the Environmental Management Branch, Division of Environmental Health and Community Safety, 275 E. Main St., Frankfort, KY 40601 (telephone 502/564-4856).

Routine Water Well Maintenance and Disinfection Guide



Natural Resources and
Environmental Protection Cabinet
Department for Environmental Protection
Division of Water

Prepared by the:
Groundwater Branch
Kentucky Division of Water
Department for Environmental Protection
14 Reilly Road
Frankfort, KY 40601
Phone 1-(502)-564-3410

August 1, 2001 version

Routine Water Well Maintenance and Disinfection Guide

Routine well disinfection (sometimes called shock chlorination) is a technique that helps keep water from properly constructed wells, a safe and dependable source of drinking water. It also helps reduce nuisance problems such as staining and odors.

Why should I do routine well maintenance and disinfect my well?

Bacteria and viruses, which are accidentally introduced into a well or the plumbing and pipes of a home, can most of the time be eliminated, thus providing safer water. The bacteria that can be eliminated include the total coliform and fecal coliform bacteria which water supplies and health departments run laboratory tests for.

The odors and staining caused by iron, manganese, and sulfur can be reduced and sometimes eliminated through routine well disinfection, resulting in clearer, better tasting and appealing water for you and your family.

The cost of water treatment is often reduced, since iron and sulfur bacteria release iron, manganese, and hydrogen sulfide gas (rotten egg smell) as waste products. Water treatment equipment repairs and water treatment chemical usage may be lowered.

The useful life of the well can be extended, resulting in longer well life an reducing the possibility of costly well rehabilitation. The useful life of the pump, pressure tank, and piping is also increased. Iron and sulfur bacteria can make water more acidic, resulting in corrosion of metal parts in addition to the stresses placed on the pump due to restrictions created by bacterial growths.

The cost to pump water is reduced since plugging of the aquifer and piping system by bacteria slimes is minimized. The pump doesn't have to work as hard, so electrical costs are sometimes minimized.

Routine well inspections during regular well disinfections allow problems with a well to be found early before those problems become serious. Repairs made early cost less and help protect your water source.

Routine well disinfection is an inexpensive process that most well owners can do themselves for a few dollars and a couple of hours of work. The disinfectant,

straight chlorine laundry bleach, can be bought at the local grocery store.

When should I disinfect my well?

Well and distribution system disinfection should be performed after any of the following are performed or noted:

After a new well is drilled or the well is otherwise modified.

After a pump repair or replacement.

After the plumbing system has been newly installed, opened, drained, repaired or modified in any way. This could include repair of broken or leaking pipes, installation of a tee to a new faucet or hydrant, draining the system to prevent freezing during a trip, after an extended time period of no use, or any other situation where air, dirt, or hands have touched the inside of the piping system. Failure to disinfect the piping after a repair is potentially exposing your family to pathogenic (disease-causing) organisms.

After the well is covered by floodwaters. Wells in flood-prone areas should have well seals (with watertight gaskets) and the vent extended above the highest known flood level to minimize the possibility of floodwater entering the well. Floodwaters can introduce bacteria and other pathogenic organisms into a well.

After you first notice signs of staining or odors from iron or sulfur bacteria. Iron and sulfur bacteria can be controlled with routine disinfection.

At least once a year as preventative maintenance, even if no problems have been observed or no repairs to the well, pump, or distribution system have been made. Wells with iron and sulfur bacteria may require frequent disinfection with higher chlorine levels to keep growths under control.

What are fecal coliform bacteria?

Fecal coliform bacteria are a family of hundreds of different strains of bacteria.

Most, but not all, are harmless to humans.

They normally live in the intestines of humans and animals.

They are used as an inexpensive test to determine if harmful pathogens (disease-causing organisms) are likely to be present. If no fecal coliform bacteria of any type are present in a sample, it is assumed that no harmful bacteria or viruses are present.

They are one of the many types of coliform bacteria which show up in a “Total Coliform Bacteria” test.

A few varieties produce toxins that can cause illness. The E. Coli 0157:H7 is a variety that has been in the news lately. It is the coliform bacteria associated with cattle and improperly cooked beef. The only known occurrences in wells have been associated with shallow wells near places where cattle are kept.

Chlorine, short wave ultraviolet light, boiling, and ozone all act to kill or inactivate these bacteria.

If your well water shows positive for Total Coliform, you should disinfect the well and distribution system and have it tested again. If the well tests positive for Total Coliform again, a chlorinator or ultraviolet light disinfection system is an option to correct the potential problem.

Fecal coliform bacteria are rare in groundwater unless there is a direct connection to the surface. Wells that become muddy or cloudy after a rain generally have a direct connection to the surface. Examples include:

Shallow Groundwater – wells less than 20 feet deep or wells that have less than 20 feet of casing.

Open Wells – wells which have no cap or seal or a leaking cap or seal

Cave Streams – wells that pull water from cave streams

Improperly Sealed Casing – wells which have an opening between the casing and the drill hole which allows water to drain from the surface to the groundwater

Hand-dug wells and wells that have buried wellheads. These problem wells may require replacement or continual treatment to provide safe water.

A fecal coliform bacteria sample can be easily contaminated to produce a false positive result. The well may be clean, but samples taken from the faucet may be contaminated.

Source: Modified from data from the USEPA web site on fecal coliform bacteria.

Iron and Sulfur Bacteria

The iron and sulfur bacteria are not known to be harmful to health but are a nuisance causing red, orange, brown, or black slimy stains; musty, "rotten egg", or sulfur odors; and red or orange coloration of the water. They grow on small amounts of iron, manganese, and sulfur dissolved in natural groundwater and rock. They occur naturally in aquifers.

They need only a small amount of air to grow and flourish in a well bore. The agitation, aeration, and induced flow of water to the well bore by the pumping can provide an environment with the small amounts of air, iron, manganese, and sulfur which allows them to flourish. The water flow from the pump can also provide a constant flow of nutrients to the iron and sulfur bacteria around the well and in the pipes, pressure tank, and water heater to allow them to grow very well.

Iron and sulfur bacteria do not show up on a standard Total Coliform Bacteria test or Fecal Coliform test. The first indication of a developing iron and sulfur bacteria problem is the development of red, orange, brown, or black slimes in the toilet tank. Biological Activity Reaction Tests (BARTs) are available for testing for iron and sulfur bacteria in well water. These bacteria can not be eliminated, but they can be controlled through routine well and distribution system disinfection to minimize or eliminate the nuisance effects.

How can these bacterial problems be controlled?

Proper well and distribution system maintenance and routine well disinfection are the keys to controlling and preventing these problems. An inspection of the well and distribution system should occur **at least** once a year and should include:

1. Inspecting the cap or seal to make sure it's in place and secure. The vent should have a screen over the vent hole to prevent insects and rodents from entering the well. In most cases a vent is needed to help a well produce water more efficiently, but can sometimes be plugged in lower-use domestic wells with little noticeable affects. The best type of vents are the ones which allow a little air to enter from the bottom of a U tube, thus preventing things spilled, dumped, or dropped onto the vent from entering the well.

2. Inspecting the ground around the casing to check for slumping and settlement. Backfill slumped holes around the well casing with compacted clay soil. The land surface around the well casing should slope away from the well to prevent the ponding of surface water.

3. Make sure that things are not kept around the well that could release contaminants to the well. (A good rule of thumb is: If you're not willing to drink what could be spilled, leaked, or produced by something, it shouldn't be kept near the well.) Examples include fuel cans, fertilizer, pesticide containers, paint, dog or animal pens, gasoline and diesel-powered tools and vehicles, and solvents.

4. Inspect the piping, wiring, and pressure tank for leaks, excess corrosion, and general condition. If you have a leak or something doesn't look right, have a certified water well driller or plumber check it out.

When should my well and plumbing system be disinfected?

Any time there has been a repair or replacement of the pump or well.

Any time there has been a repair of broken or leaking pipes.

After you install of a new faucet or hydrant.

After the system has been drained to prevent freezing while you are away.

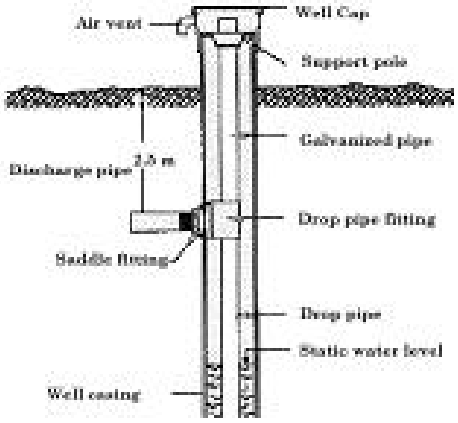
After a well has been unused for an extended period of time and is being put back into service.

Any other situation where air, dirt, or hands have touched the inside of the piping system pump or well.

How Do I Disinfect or Shock Chlorinate My Well and Plumbing System?

The disinfection process generally consists of the following: Adding chlorine to the well, circulating the chlorinated water back down the well, running water to each hot and cold faucet until you smell chlorine, letting the system sit for a minimum of 2 hours (overnight is preferable) and draining the chlorinated water out using an outside faucet.

Once you've disinfected or shock chlorinated the well and plumbing system the first time, you'll find that it's much like cleaning out the gutters or trimming the hedges, you



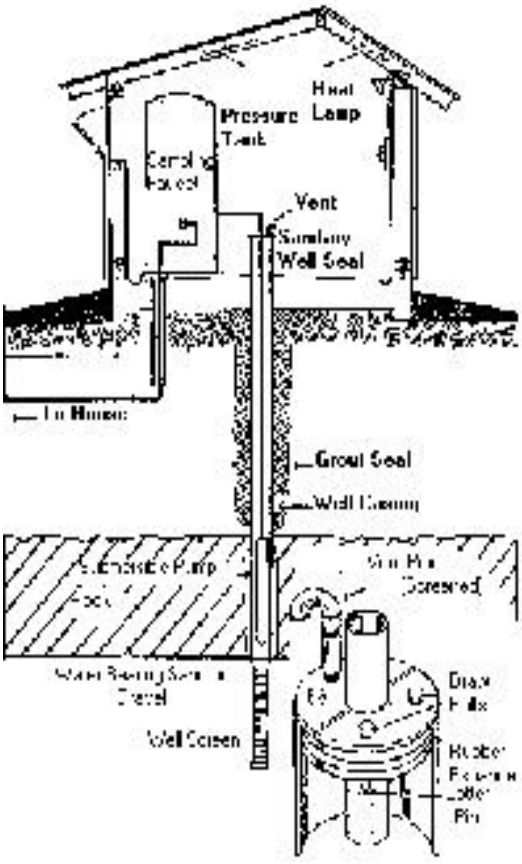
don't have to do it very often and all it takes is a little time and commitment. After all, you are the water plant operator of your own little water system, and the condition of the water coming out of the tap depends on the way you care for your system and the maintenance you provide.

Accessing Your Well

You need to have access to the top of the well casing. If you have a well with a buried wellhead (you have to dig a hole to access the top of the well casing), you should get a certified driller to upgrade your well by installing a ***pitless adapter unit***. A pitless adapter unit allows the water pipe to exit the side of the casing below the ground surface while providing a water tight seal which prevents bacteria and soil critters from getting into your well (see the diagram to the left).

Wells with pitless units have the casing extending up above the ground surface. Wells which have pitless adapter units have a cap that sits down over the well casing (sometimes they have three little set screws on the side of the cap to secure it).

If your water pipe(s) and electrical wires come out of a metal plate on top of the well, which has four bolts in it, you have what is called a ***sanitary seal*** (see figure to the right). The pump and pipe hang on a sanitary seal, so do not loosen the bolts and raise this unless you know what you are doing. Instead you can access the well through the vent pipe.



If this has you confused, ask your certified well driller to show you how to get access to your well for routine well disinfection. Modifications to the vent can allow chlorine to be added to a well by removing a plug.

If your submersible pump wires come out of the vent hole, you may need to have the certified driller install a different sanitary seal that has a separate vent hole. See the figure to the right for more details.

If your well is newer than 1986, you should have a Kentucky Water Well Record form for your well. Since 1986, the Kentucky Certified Water Well Driller has been required by law to

provide the well owners with this record. It tells the depth of the well, diameter of the casing and static water level in the well when it was drilled among other things. Subtracting the static water level from the total depth of the well gives you the feet of standing water in the well. You can use the number of feet of standing water in your well and the diameter to determine the amount of chlorine you need to disinfect your well.

Amount of Chlorine You Need to Add

You need to calculate the amount of water in your well. Once you calculate these numbers the first time, you can use the same numbers each time you disinfect the system. To do this you need to know the diameter of the inside of the casing and the approximate number of feet of water standing in your well.

If you know these numbers, use the chart below to determine how much chlorine you need. This chart also assumes that your plumbing system has about 100 of gallons of water and this is included in this chart. If your well is different from those in this chart, you can go to Appendix 1 and calculate the exact amount for your well and plumbing system.

Amount of household Laundry Bleach Needed to Disinfect a Well and Plumbing System

Feet of Standing Water in The Well	4-inch inside casing diameter	5-inch inside casing diameter	6-inch inside casing diameter	7-inch inside casing diameter	8-inch inside casing diameter	10-inch inside casing diameter
10 feet	1 quart + 2 1/3 cups	1 quart + 2 2/3 cups	1 quart + 2 7/8 cups	1 quart + 3 ¼ cups	1 quart + 3 5/8 cups	2 quarts + ½ cups
20 feet	1 quart + 2 ¾ cups	1 quart + 3 ¼ cups	1 quart + 3 ¾ cups	2 quarts + ½ cups	2 quarts + 1 1/8 cups	2 quarts + 1 ½ cups
30 feet	1 quart + 3 ¼ cups	2 quarts	2 quarts + 5/8 cups	2 quarts + 1 5/8 cups	2 quarts + 2 ¾ cups	3 quarts + 1 1/3 cups
40 feet	1 quart + 3 ½ cups	2 quarts + ½ cups	2 quarts + 1 ½ cups	2 quarts + 2 7/8 cups	3 quarts + ¼ cups	3 quarts + 3 ¾ cups
50 feet	2 quarts	2 quarts + 1 cup	2 quarts + 2 ½ cups	3 quarts	3 quarts + 1 7/8 cups	4 quarts + 2 ¼ cups
60 feet	2 quarts + 1/3 cups	2 quarts + 1 2/3 cups	2 quarts + 3 ¼ cups	3 quarts + 1 ¼ cups	3 quarts + 3 3/8 cups	5 quarts + 2/3 cups
70 feet	2 quarts + ¾ cups	2 quarts + 2 ¼ cups	3 quarts + 1/8 cups	3 quarts + 2 ½ cups	4 quarts + 1 cup	5 quarts + 3 1/8 cups
80 feet	2 quarts + 1 1/8 cups	2 quarts + 2 7/8 cups	3 quarts + 1 cup	3 quarts + 3 5/8 cups	4 quarts + 2 ½ cups	6 quarts + 1 5/8 cups
90 feet	2 quarts + 1 ½ cups	2 quarts + 3 ½ cups	3 quarts + 2 cups	4 quarts + 7/8 cups	5 quarts + 1/8 cups	7 quarts
100 feet	2 quarts + 2 cups	3 quarts + 1/8 cups	3 quarts + 2 7/8 cups	4 quarts + 2 cups	5 quarts + 1 5/8 cups	7 quarts + 2 ½ cups
Chlorine/10 ft. for more than 100 ft of water	*3/8 cups*	*5/8 cups*	*7/8 cups*	*1 ¼ cups*	*1 ½ cups*	*2 ½ cups*

Diagram shows approximate amounts of straight laundry bleach needed to achieve ~200-PPM chlorine in the well and plumbing system rounded to the nearest 1/8 of a cup. Chart assumes 100 gallons of water in the home pipes, pressure tank, and water heater. For wells with diameters between those shown above, use the next larger size chart (4.5-inch use 5-inch). **Be sure to use only straight laundry bleach (5 ¼ % chlorine)** (usually the cheapest), **bleaches that have scents, fabric softeners, water conditioners, or color enhancers should never be used in a water well.** Double the amounts shown if treating the system for Iron and Sulfur Bacteria to achieve ~400-PPM chlorine.

Getting Started

Let everyone in the house know that you are about to disinfect the system. Have some bottled water for drinking set aside and make sure that water-intensive needs such as watering stock, baths, showers, laundry, etc., are done before adding the chlorine to the well. An occasional toilet flush is OK, but you want the chlorinated water to sit in the system and work. **You need to bypass water treatment devices such as softeners and filters.** These devices usually have a bypass valve to redirect the water around the device. You may want to contact the manufacture or the service technician for your treatment device to find out about its tolerance to chlorine and how to operate the bypass valve. You should also minimize the amount of chlorinated water running down the drain to your septic system since septic systems rely on bacteria to break down waste and chlorine can kill these beneficial bacteria.

Adding the Chlorine to the Well

Pour the chlorine solution into the well, trying to make it run down the sides and pipe. Attach a garden hose to the closest hose attachment to the well and run the hose back to the well. Re-circulate the chlorinated water down the well, rinsing the sides, piping, and wires down for a minimum of 15 minutes.

Go to every faucet in the house, starting with the ones closest to the well and let them run until you smell chlorine and then turn them off. Do this with both the hot and the cold faucets, run the washer and dish washer on warm until you smell chlorine, flush each toilet until you smell chlorine, and don't forget the outside faucets and hydrants. The idea is to completely fill every pipe in the system with the highly chlorinated water. Let the system sit for a minimum of two hours with overnight being the best.

Clearing the System of Chlorine

After the chlorine has been in the system the needed amount of time, it needs to be flushed. Use an outdoor faucet to drain the excess chlorinated water from the system. When highly chlorinated water is exposed to air, the chlorine evaporates into the air quickly. It is best to use a hose to run this water to a driveway since high concentrations of chlorine may damage plants. High concentrations of chlorine are harmful to aquatic life so do not discharge the water to a stream or creek. A lawn

sprinkler can be used to aerate and spread out the water being discharged.

After the garden hose is running clear and has no smell of chlorine, the inside faucets can be cleared. If iron and sulfur bacteria are a problem, you may find that particles of material are being discharged along with the water. These particles are dead bacteria and oxidized iron and manganese. You'll need to go to each faucet, remove the aerator and let the water run at full flow to flush this material from the lines. Be sure to run the washer and dishwasher empty through a cycle to flush this material from these lines also.

Note: If you are chlorinating your well and plumbing for an iron bacteria problem, you may have to repeat this procedure frequently to get the problem under control.

Have Your Water Tested

If you disinfected the system due to a bad Total Coliform Bacteria test or as a yearly system maintenance procedure, you should have the water tested for bacteria a week or two after the disinfection. If, after repeated disinfection and testing cycles, the Coliform tests are still coming back positive, your well may be exhibiting a possible direct connection to the surface. Wells that show connection to the surface should be repaired or properly abandoned and a new, deeper well constructed by a certified water well driller. If having the well repaired or constructing a new well is not feasible, an inline or in-well chlorinator or ultraviolet light disinfection unit should be installed to help ensure the water is safe from bacteria and viruses.

Treating the System for Iron and Sulfur Bacteria

If your well and system are being shock chlorinated for an iron and sulfur bacteria infestation, you may have to repeat the process frequently at first to get the problem under control. Extra strong chlorine solutions (400 ppm, twice the amount of chlorine from the chart) may be needed along with as long as possible contact time to allow the chlorine to work its way back into the aquifer.

Many people have found that problem wells with red, orange or black water flowing from the tap can be cleared up with persistent and frequent shock chlorination. Continuous in-well chlorinators can be installed for extremely bad iron and sulfur bacteria problems. A large back-flushable activated carbon or redox filter unit can be used to remove the excess chlorine and insoluble particles before it is distributed to the house.

In wells with extremely high iron, sulfur, and slime bacteria, a well-rehabilitation specialist may be needed to use a combination of extremely strong chemicals and procedures to bring the well back. There are times when it is cheaper to have a certified driller plug the infested well and drill a new one. If a new well is drilled by a certified water well driller, you should disinfect the well at least once a year to ensure your investment and water quality retains its value over the life of the well. Be sure and

to have the certified driller properly plug and seal your old well to eliminate a pathway for surface pollution to enter groundwater.

A well does have a limited life but usually will provide 20 years or more of service before major rehabilitation/reconstruction or replacement if simple routine maintenance and routine well disinfection procedures are followed. When you have a new well drilled, extra protection, such as more than the minimum length of casing and grouting the casing into the drill hole, can cost more but are worth it. These precautions can help to protect your well water from infiltration of surface water, which could be a source of pathogens, and helps to ensure that your well will have a long, productive life while protecting your family's health and safety.

Appendix A

You can measure the casing inside diameter or get this from the well log if you have one. Look this number up in **Table 1** to determine the number of gallons of water per foot of casing. The number of feet of water standing in the well can be calculated by subtracting the static water level (distance from the top of the well to the top of the water) from the total depth of the well from the top of the casing to the bottom of the well. You may know these numbers already from the water well log or from when the well was drilled and can use them directly. You can also call the driller who drilled the well and ask if he has these records on the well. You can also make arrangements with a certified water well driller to make these measurements of your well for you.

Total Depth - Static Water Level = Feet of Water Standing in a Well

Feet of Water Standing in Well X Gallons of Water per Foot = Gallons of Water in Well

If you have a standard system and pressure tank, you can assume that the piping, pressure tank, and water heater have about 100 gallons of water in them. Add 100 gallons to the number of gallons of water in the well to get the number of gallons of water in the well and water system. If you have a larger than normal pressure tank, a water storage tank, or longer than normal pipe runs, you may need to make additions for their extra capacity. It will not harm your well if you over chlorinate it. The only problem it causes is it take longer to flush the chlorine from the well and system.

Use **Table 2** to determine the amount of chlorine product needed to bring the well and water system water to approximately 200 PPM chlorine. Systems with bad iron and sulfur bacteria infestations may require 400 PPM or more to deal with the problem, so double the amounts of chlorine. **Table 2** gives the amounts of various chlorine products needed per 100 gallons of water in the well and water system. The powdered and concentrated liquid products should be premixed with 5 or 10 gallons of water before it is poured into the well. Pellets may be too big to fit through the vent on a sanitary seal and require you to pre-dissolve them in water. Always use a plastic or glass container or bucket when mixing concentrated chlorine solutions, since strong chlorine solutions can sometimes react with metal.

Table 1. Well Volume

Well/Pipe Diameter (Inches)	Gallons of water for each Foot of Water Depth in a well (Gallons/Ft. of Water)	*Well/Pipe Diameter* (Inches)	Gallons of water for each Foot of Water Depth in a well (Gallons/Ft. of Water)
2	0.163	12	5.87
3	0.367	20	16.23
4	0.653	24	23.5
5	1.02	36	52.9
6	1.47	48	94
8	2.61	60	147

Modified from Powell, G.M.,1990, Shock Chlorination for disinfecting Water Systems, MF-911, Kansas Cooperative Extension Service

Table 2. Chlorine Mix Ratio for Shock Chlorination*

Chlorine Source	Percent Chlorine	Form*	Amount to Add *
Laundry bleach-Chlorox, Purex, Hi-Lex, etc.	5 ¼	Liquid	3pt/100 gal.
Swimming pool-disinfectant or concentrated chlorine bleach	12-17	Liquid	1pt/100 gal.
Dairy sanitizer	30	Powder	4oz/100 gal.
High-test calcium hypochlorite, HTH Pittchlor, Perchloron, etc.	65-75	Powder	3pt/100 gal.

*Makes approximately 200 ppm (200 mg/l) concentrations. For stronger concentration increase the amount; for weaker solution decrease the amount. -Be sure that chlorine is the only active ingredient. Sometimes other materials such as algaecide may be added to bleaches or pool disinfectants. Material intended for disinfection normally contains only chlorine as the active ingredient. Other halogens such as iodine or bromine may also be included. These normally should be avoided since they do not evaporate as chlorine does, so they remain in the water. If used, greater care should be exercised when disposing of the treatment solution. Some laundry bleaches have scents, water conditioners, and softening agents added, these products are more expensive and should never be used to disinfect a well.

Modified from Powell, G.M.,1990, Shock Chlorination for disinfecting Water Systems, MF-911, Kansas Cooperative Extension Service

Notes:

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